

COURSE NAME; NUMBER; SEMESTER; MEETING DAYS, TIMES, AND PLACE:

Course Number 11:680:490

Molecular Mechanisms of Virulence

3 Credits, synchronous in-person

Spring 2026

Prerequisites: General Microbiology (11:680:390) OR Genetics (01:447:380) AND Introduction to Microbiology (11:680:201)

Time TBD

Location TBD

CONTACT INFORMATION:

Instructor(s): Zachery R. Lonergan, Ph.D.

Office Location: 120 Lipman Hall

Phone: (848) 932-5618 Email: z.lonergan@rutgers.edu

Office Hours: Synchronous office hours on Wednesdays from 4-5:00 PM via Zoom or in-person. Attendance is not required and is available by email reservation at least 24 hours before the scheduled time. Reasonable accommodations will be made for those unable to attend office hours at this time and can be arranged by email.

COURSE WEBSITE, RESOURCES AND MATERIALS:

- Recommended Textbook: Bacterial Pathogenesis: A Molecular Approach, by Wilson, Winkler, and Ho – not required (ISBN 13: 978-1555819408). Other content will be derived from other materials including primary scientific literature and will be provided weekly by the instructor.

COURSE DESCRIPTION:

Molecular Mechanisms of Virulence is a course focused on enhancing understanding of how bacteria use molecular machines to promote their survival in the hostile host environment, usually during infections. This course is designed for those with an understanding of basic microbial physiology and genetics and is targeted towards juniors and seniors majoring in microbiology, biochemistry, biotechnology, and related fields. Each week, this course will focus on different molecular and biochemical mechanisms bacteria use to promote their own survival and will include specific examples from primary literature on our current knowledge for how these systems function. After completing this course, students will have conceptual and technical understanding of the diverse ways bacteria cause infections at a molecular level.

LEARNING GOALS:

1. Summarize and explain the molecular mechanisms and biology of bacterial survival in host environments.
2. Correlate molecular mechanisms of microbial processes with important bacterial pathogens.
3. Evaluate primary scientific literature related to discoveries of molecular mechanisms of bacterial pathogenesis.
4. Describe the diversity in molecular and biochemical processes that govern bacterial pathogen adaptation.

ASSIGNMENTS/RESPONSIBILITIES, GRADING & ASSESSMENT:

The primary mode of assessment will occur via three exams over the semester. The third exam will serve as the final and will include approximately 50% cumulative material from the other exams. Additional assessment will come in the form of weekly questions paired with primary literature related to the lecture topics of the week that will be turned in online. Students will also be evaluated for their participation during class through questions and small group discussion.

Assessment

- 3 exams, 25% each (2 during term, 1 final)
- Weekly question responses from primary literature and class lecture: 15%
- In Class Participation: 10%

Grading Scale

- A: 90.0-100
- B+: 85.0-89.9
- B: 80.0-84.9
- C+: 75.0-79.9
- C: 70.0-74.9
- D+: 65.0-69.9
- D: 60.0-64.9
- F: 59.9 and below

ACCOMODATIONS FOR STUDENTS WITH DISABILITIES

Please follow the procedures outlined at <https://ods.rutgers.edu/students/getting-registered>. Full policies and procedures are at <https://ods.rutgers.edu/>

ABSENCE POLICY

Students are expected to attend all classes; if you expect to miss one or two classes, please use the University absence reporting website <https://sims.rutgers.edu/ssra/> to indicate the date and reason for your absence. An email is automatically sent to me.

COURSE SCHEDULE:

Course content will include the following topics:

- Introduction to Bacterial Pathogenesis & Host Immunity
- Introduction to Bacterial Lifestyles – Intracellular vs Extracellular Survival
- Bacterial Metabolism During Infection
- Motility and Virulence
- Two Component Systems & Gene Expression
- Quorum Sensing Systems
- Secretion Systems Type 1-3
- Secretion Systems Type 4-9
- Bacterial Effector Proteins
- Biofilms/Matrix Production
- Capsules

- Adhesion
- Siderophore Production & Nutrient Scavenging
- Toxins
- Toxin-Antitoxin Systems
- Bacterial Immunity Systems
- Microbe-microbe Competition
- Microbe-microbe Coordination
- Innate Immune Evasion
- Adaptive Immune Evasion
- Chronic Infections
- Latent/Persistent Infections

FINAL EXAM/PAPER DATE AND TIME

Online Final exam Schedule: <http://finalexams.rutgers.edu/>

ACADEMIC INTEGRITY

The university's policy on Academic Integrity is available at <https://academicintegrity.rutgers.edu/sites/default/files/pdfs/current.pdf>. The principles of academic integrity require that a student:

- properly acknowledge and cite all use of the ideas, results, or words of others.
- properly acknowledge all contributors to a given piece of work.
- make sure that all work submitted as his or her own in a course or other academic activity is produced without the aid of impermissible materials or impermissible collaboration.
- obtain all data or results by ethical means and report them accurately without suppressing any results inconsistent with his or her interpretation or conclusions.
- treat all other students in an ethical manner, respecting their integrity and right to pursue their educational goals without interference. This requires that a student neither facilitate academic dishonesty by others nor obstruct their academic progress.
- uphold the canons of the ethical or professional code of the profession for which he or she is preparing.

Adherence to these principles is necessary in order to ensure that

- everyone is given proper credit for his or her ideas, words, results, and other scholarly accomplishments.
- all student work is fairly evaluated, and no student has an inappropriate advantage over others.
- the academic and ethical development of all students is fostered.
- the reputation of the University for integrity in its teaching, research, and scholarship is maintained and enhanced.

Failure to uphold these principles of academic integrity threatens both the reputation of the University and the value of the degrees awarded to its students. Every member of the University community therefore bears a responsibility for ensuring that the highest standards of academic integrity are upheld. Cheating on tests or plagiarizing materials in papers will be taken seriously and not tolerated – this includes the copying of text produced via Generative AI (ie, ChatGPT). All suspected cases of cheating and plagiarism will be referred to the Office of Judicial Affairs, and will recommend penalties appropriate to the gravity of the infraction. To help protect you, and future students, from plagiarism, all papers will be submitted through TurnItIn.com and screened for plagiarized text and Generative AI-sourced language.

SEBS DEI STATEMENT

Students of all backgrounds should be well served by this course, and, as such, we will work to create an environment of inclusion which respects and affirms the inherent dignity, value, and uniqueness of all individuals, communities and perspectives. Rutgers is a diverse community: Diverse voices and life experiences enhance the learning process and we welcome students to share their personal experiences. We will not tolerate disrespectful language or behavior against any individual or group. If you feel as though you have been disrespected or treated unfairly by the instructors or any other individual please let us know. You may speak with the instructors in person, over email or report anonymously via the Office of Academic Programs. In addition, you may also report bias to the Rutgers Diversity and Inclusion initiative using this link: <http://inclusion.rutgers.edu/report-bias-incident/>

STUDENT WELLNESS SERVICES

Counseling, ADAP & Psychiatric Services (CAPS)

(848) 932-7884 / 17 Senior Street, New Brunswick, NJ 08901/ www.rhscaps.rutgers.edu/

CAPS is a University mental health support service that includes counseling, alcohol and other drug assistance, and psychiatric services staffed by a team of professionals within Rutgers Health services to support students' efforts to succeed at Rutgers University. CAPS offers a variety of services that include individual therapy, group therapy and workshops, crisis intervention, referral to specialists in the community and consultation and collaboration with campus partners.

Violence Prevention & Victim Assistance (VPVA)

(848) 932-1181 / 3 Bartlett Street, New Brunswick, NJ 08901 / <https://vpva.rutgers.edu/>

The Office for Violence Prevention and Victim Assistance provides confidential crisis intervention, counseling, and advocacy for victims of sexual and relationship violence and stalking to students, staff, and faculty. To reach staff during office hours when the university is open or to reach an advocate after hours, call 848-932-1181.

Disability Services

(848) 445-6800 / Lucy Stone Hall, Suite A145, Livingston Campus, 54 Joyce Kilmer Avenue, Piscataway, NJ 08854 / <https://ods.rutgers.edu/>

Rutgers University welcomes students with disabilities into all of the University's educational programs. In order to receive consideration for reasonable accommodations, a student with a disability must contact the appropriate disability services office at the campus where you are officially enrolled, participate in an intake interview, and provide documentation: <https://ods.rutgers.edu/students/documentation-guidelines>. If the documentation supports your request for reasonable accommodations, your campus's disability services office will provide you with a Letter of Accommodation. Please share this letter with your instructors and discuss the accommodations with them as early in your courses as possible. To begin this process, please complete the Registration form on the ODS web site at: <https://webapps.rutgers.edu/student-ods/forms/registration>.

DoSomething button through Rutgers Dean of Students office:

<http://health.rutgers.edu/do-something-to-help/>

Wellness Coaching through Rutgers HOPE:

<https://health.rutgers.edu/health-education-and-promotion/health-promotion-peer-education/wellness-coaching>

Self-Help Apps found on the Rutgers Student Health website:

<https://health.rutgers.edu/health-education-and-promotion/self-help/self-help-apps>

NJ Hopeline - (1-855-654-6735) | **National Suicide Hotline** - (1-800-273-8255)

BASIC NEEDS RESOURCES

Any student who has difficulty affording groceries or accessing sufficient food, or who lacks a safe and stable place to live, is urged to contact the Rutgers Student Food Pantry and/or the Dean of Students (details below). Furthermore, please notify the professor if you are comfortable doing so, as they may be able to provide additional support.

Rutgers Student Food Pantry

848-932-5500 / College Ave Student Center, Room 115 (126 College Ave) /

<http://ruoffcampus.rutgers.edu/food/>

Check their website for hours and additional locations. The Rutgers Student Food Pantry is dedicated to helping all Rutgers students in need of food, no questions asked. Students will be provided with groceries that typically last about one week.

Dean of Students Office

848-932-2300 / 88 College Avenue, New Brunswick, NJ 08901 / <https://deanofstudents.rutgers.edu/>

Mon-Fri, 8:30am-5:00pm

The Dean of Students Office at Rutgers University-New Brunswick provides solutions, services, and support to help students navigate Rutgers University. The Office serves as a student support network by providing advocacy, problem resolution, and critical incident intervention for those times when additional assistance is needed. Please call to schedule an appointment to meet with a representative from the Dean's office.